The Ohio State University
Department of Astronomy
4055 McPherson Laboratory
140 W. 18th Ave.
Columbus, OH 43210
https://apaiasno.github.io/

# ANUSHA J. PAI ASNODKAR

NASA Space Technology Graduate Research Fellow
Exoplanet atmospheres ⋄ Instrumentation
paiasnodkar.1@osu.edu

## Education

The Ohio State University — Columbus, Ohio

July 2025 **Anticipated Ph.D. in Astronomy**
Thesis Advisor: Prof. Ji Wang

May 2022 **M.S. in Astronomy**
Candidacy Advisor: Prof. Ji Wang

California Institute of Technology — Pasadena, California

June 2019 **B.S. in Physics, Division of Physics, Math, and Astronomy**
Thesis Advisor: Dr. Inseob Hahn

## Experience

**Graduate Research Fellow** **08/19 — Present**
*The Ohio State University, Department of Astronomy, Advisor: Prof. Ji Wang*

- Atmospheric dynamics of ultra-hot Jupiters with high-resolution transmission spectroscopy and photometric phase curves
  *Skills/Software: Python, MCMC, Gaussian Processes, spectroscopy*
- Dual-aperture fiber nuller testbed for detection of exoplanets at high contrast
  *Skills/Software: Optics, MATLAB, Python*

**NASA Jet Propulsion Laboratory Summer Intern** **07/24 — 08/24**
*NASA Jet Propulsion Laboratory, Division 3260, Mentor: Dr. Eugene Serabyn*

- Characterization and modelling of polarization-based phase masks for starlight rejection with fiber nulling
  *Skills/Software: Optics, MATLAB*

**NASA Jet Propulsion Laboratory Year-Round Intern** **09/18 — 06/19**
*NASA Jet Propulsion Laboratory, Division 382J, Mentor: Dr. Inseob Hahn*

- Subpixel detector characterization with laser interferometry for precision astrometry
  *Skills/Software: Optics, Python, MATLAB*

**Caltech SFP Summer Undergraduate Research Fellow** **06/16 — 08/18**

- *NASA Jet Propulsion Laboratory, Division 382J, Mentor: Dr. Inseob Hahn 06/18 —08/18*
  Numerical modeling of critical phenomena
  *Skills/Software: Mathematica, numerical methods*

- *Caltech, APhMS Department, Mentor: Prof. Andrei Faraon* *06/17 —08/17*
  Design and construction of an extended cavity diode laser
  *Skills/Software: Optics, electronics, MATLAB, Mathematica*

- *Caltech, PMA Department, Mentor: Prof. Judy Cohen* *06/16 —08/16*
  Quantifying the oblateness of the Milky Way's Outer Halo with RR Lyrae
  *Skills/Software: Python, time-series analysis*

**Apprenticeships in Science and Engineering at teuscher.:Lab** **06/12—06/15**
*Portland State University, ECE Department, Mentor: Prof. Christof Teuscher*

- Modelling and analysis of Network-on-chip architectures to optimize traffic throughput
  *Skills/Software: MATLAB, graph theory*

# Publications

Lead-Author Publications *(reverse chronological order)*

1. **PEPSI's non-detection of escaping hydrogen and metal lines adds to the enigma of WASP-12 b**
   ***Pai Asnodkar, A.***, Wang, J., Broome, M., Huang, C., Johnson, M., Ilyin, I., Strassmeier, K., Jensen, A., accepted for publication to *MNRAS*, arXiv:2410.21493

2. **Dual-aperture fiber nulling for high spatial and spectral resolution studies of exoplanets** ***Pai Asnodkar, A.***, Wang, J., Jurgenson, C., Crass, J. (2024). In "Optical and Infrared Interferometry and Imaging IX" (pp. 130952J), *SPIE*.

3. **Variable and super-sonic winds in the atmosphere of an ultra-hot giant planet**
   ***Pai Asnodkar, A.***, Wang, J., Eastman, J., Cauley, P., Gaudi, B., Ilyin, I., and Strassmeier, K. (2022). *AJ*, 163(4), 155.

4. **KELT-9 as an eclipsing double-lined spectroscopic binary: a unique and self-consistent solution to the system**
   ***Pai Asnodkar, A.***, Wang, J., Gaudi, B., Cauley, P., Eastman, J., Ilyin, I., Strassmeier, K., and Beatty, T. (2022). *AJ*, 163(2), 40.

Contributing Author Publications *(reverse chronological order)*

1. **PEPSI Investigation, Retrieval, and Atlas of Numerous Giant Atmospheres (PIRANGA). I. The Ubiquity of Fe I Emission and Inversions in Ultra Hot Jupiter Atmospheres**
   Petz, S., Johnson, M., ***Pai Asnodkar, A.***, Duck, A., Wang, J., Ilyin, I., Strassmeier, K. (2024). arXiv e-prints, arXiv:2407.09643.

2. **The PEPSI Exoplanet Transit Survey (PETS) - IV. Assessing the atmospheric chemistry of KELT-20 b**
   Petz, S., Johnson, M., ***Pai Asnodkar, A.***, Wang, J., Gaudi, B., Henning, T., Keles, E., Molaverdikhani, K., Poppenhaeger, K., Scandariato, G., Shkolnik, E., Sicilia, D., Strassmeier, K., Yan, F. (2024). *MNRAS*, 527(3), 7079-7092.

3. **Exploring the potential of Twinkle to unveil the nature of LTT 1445 A b**
   Phillips, C., Wang, J., Edwards, B., Rodríguez Martínez, R., ***Pai Asnodkar, A.***, Gaudi, B. (2023). *MNRAS*, 526(2), 2251-2264.

4. **A Comparison of the Composition of Planets in Single-planet and Multiplanet Systems Orbiting M dwarfs**
   Rodríguez Martínez, R., Martin, D. V., Gaudi, B., Schulze, J., ***Pai Asnodkar, A.***, Boley, K., Ballard, S. (2023). *AJ*, 166(4), 137.

5. **The PEPSI-LBT Exoplanet Transit Survey (PETS). II. A Deep Search for Thermal Inversion Agents in KELT-20 b/MASCARA-2 b with Emission and Transmission Spectroscopy**
   Johnson, M. C., Wang, J., ***Pai Asnodkar, A.***, et al. (2023). *AJ*, 165(4), 157.

6. **A Reanalysis of the Composition of K2-106 b: an Ultra-short Period Super-Mercury Candidate**
   Rodríguez Martínez, R., Gaudi, B., Schulze, J., Acuña, L., Kolecki, J., Johnson, J., ***Pai Asnodkar, A.***, Boley, K., Deleuil, M., Mousis, O., Panero, W., and Wang, J. (2022). *AJ*, 165(3), 97.

7. **Retrieving the C and O Abundances of HR 7672 AB: A Solar-type Primary Star with a Benchmark Brown Dwarf**
   Wang, J., Kolecki, J., Ruffio, et al., including ***Pai Asnodkar, A.*** (2022). *AJ*, 163(4), 189.

8. **A Structural Analysis of Evolved Complex Networks-on-Chip**
   Chung, H., ***Pai Asnodkar, A.***, and Teuscher, C. (2012). In Proceedings of the Fifth International Workshop on Network-on-Chip Architectures (NoCArc '12). ACM, New York, NY, USA, 17-22. http://doi.acm.org/10.1145/2401716.2401721

# Observing Proposals

1. TESS Cycle 6 General Investigator Program: Albedo And Atmospheric Variability of Hot Jupiters (Science PI: Anusha Pai Asnodkar, Institutional PI: Dr. Marshall Johnson), awarded $70,000

2. Large Binocular Telescope (PEPSI): Variable atmospheric dynamics of misaligned ultra-hot Jupiters around gravity-darkened stars (PI), awarded 9 hours, 2022B.

# Awards and Honors

**Ann S. Tuttle Citizenship, Engagement, and Outreach Prize (2023)**
Awarded for efforts to engage the public and contribute to OSU astronomy department's diverse community.
**Ann S. Tuttle Paper Award (2023)**
Awarded for the best first-author publication by an OSU astronomy graduate student from the preceding year.
**NASA Space Technology Graduate Researcher (2022)**
Recipient of NSTGRO fellowship for "Dual-Aperture Fiber Nulling For High Spatial and Spectral Resolution Studies of Exoplanets".
**2021 Edward F. Hayes Research Forum (The Ohio State University)**
Selected to present an oral presentation and awarded honorable mention in the category of Mathematical and Physical Sciences.

**The David G. Price Fund-Research Associateship in Astronomical Instrumentation**
Received fellowship twice from 2020-2022.

# Oral Presentations

**Resolving exoplanet atmospheres across environments**
*Shanghai Astronomical Observatory ET seminar (virtual), invited, September 2024*
**Exoplanets at high-resolution with the Large Binocular Telescope**
*UC Santa Cruz Planet Lunch (virtual), invited, February 2024*
**Strike while the iron is hot: a deep dive into understanding the variability of KELT-9 b's atmospheric dynamics**
*AAS 243, New Orleans, January 2024*
**The Present and Future of Exoplanet Atmospheric Characterization with the LBT**
*Other Worlds Laboratory Summer Program, University of California, Santa Cruz, July 2023*
**Dual-Aperture Fiber Nulling for High Spatial and Spectral Resolution Studies of Exoplanets**
*Coherent Differential Imaging Workshop, Paris Observatory in Meudon, France, June 2023*
**WASP-12 b's Enigmatic Atmospheric Dynamics**
*Great Lakes Exoplanet Area Meeting (GLEAM), The Ohio State University, November 2022*
**Variable Atmospheric Dynamics of Planets Experiencing Gravity-Darkened Seasons**
*Thinkshop 2022: High-resolution spectroscopy for exoplanet atmospheres and biomarkers, Virtual, September 2022*
**Variable and Super-sonic Winds in the Atmosphere of an Ultra-hot Jupiter**
*IAU Symposium 370 "Winds of Stars and Exoplanets", e-talk, August 2022.*
**Variable and Super-sonic Winds in the Atmosphere of an Ultra-hot Jupiter**
*Bay Area Exoplanet Meeting, Virtual, March 2022*
**Measuring Rapid Global-scale Winds on KELT-9 b**
*Emerging Researchers in Exoplanet Science (ERES) VII, Virtual, May 2021*
**Global-scale Winds and Dynamical Mass of the Ultra-hot Jupiter KELT-9 b**
*NASA Jet Propulsion Laboratory Exoplanet Journal Club, Virtual, May 2021*
**Caltech SFP SURF Seminar Day**
*Caltech, 2016-2018*

# Poster Presentations

**Dual-aperture fiber nulling for high spatial and spectral resolution studies of exoplanets**
*SPIE Astronomical Telescopes + Instrumentation, Yokohama, Japan, June 2024*
**Strike while the iron is hot: a deep dive into understanding the variability of KELT-9 b's atmospheric dynamics**
*Extreme Solar Systems V, Christchurch, New Zealand, March 2024*
**Strike while the iron is hot: a deep dive into understanding the variability of KELT-9 b's atmospheric dynamics**
*Exoclimes VI, University of Exeter, June 2023*
**Observational constraints on the atmospheric dynamics of the inspiraling ultra-hot**

**Jupiter WASP-12 b**
*Emerging Researchers in Exoplanet Science (ERES) VII, Penn State, August 2022*

**Variable and super-sonic winds in the atmosphere of an ultra-hot Jupiter**
*Exoplanets IV, Las Vegas, May 2022*

## Workshops and Summer Schools

**AstroTech Summer School**
*University of California, Berkeley, July 2021/2023*

**Penn State Astrostatistics Summer School**
*Virtual, June 2021*

**Erdős Institute Data Science Boot Camp**
*Virtual, May 2020*
Final group project selected within top 5.

**High-Resolution Infrared Spectroscopy for Exoplanet Characterization Hackathon**
*Caltech, February 2020*

**ZTF Summer School 2016**
*Caltech, June 2016*

## Mentorship

**OSU undergraduate Jenna Bittner** **05/24 —08/24**
Co-advised with Dr. Marshall Johnson on ultra-hot Jupiter phase curve analysis using *TESS* photometry. Conducted summer research through the OSU Summer Undergraduate Research Program (SURP).

**OSU undergraduate Phoenix Sarian** **06/23 —05/24**
Co-advised with Caprice Phillips on brown dwarf spectral classification research project, "Revisiting the Nature of IRXS J2351+3127B". Phoenix completed this project through the UCSC Lamat Institute REU Program and year-round research at OSU.

**The Ohio State University Polaris Program** **08/20 —04/24**
Provided academic/career counseling and semester-long research project mentorship for undergraduates: O'Brein Carr (2023-2024), Lily Yu (2022-2023), Jenna Bittner and Aine Fitzgerald (2021-2022), Ella Sigan (2020-2021).

**SciAccess Zenith Mentorship Program** **09/20 —12/20**
Provided academic guidance and citizen science project mentorship for blind and visually-impaired high school students interested in space sciences.

## Broader Activities

**OSU Astronomy Department Python Bootcamp** **2022-2024**
Co-instructor for a Python bootcamp aimed towards incoming graduate students and undergraduate students conducting summer research in astronomy.

**Guest instructor for OSU Order of Magnitude course for undergraduates** **2023-2024**
Formulated order-of-magnitude problems and co-taught (with Jack Roberts) 3 lessons for undergraduates in physics and astronomy.

**Guest presenter for OSU'S Astronomical Society** **9/23**
Presented a general summary of exoplanet science (detection and characterization) and ongoing efforts in OSU's Astronomy Department.

**Guest presenter for OSU Undergraduate Residential Summer Access (URSA)** **8/23**
Presented a general summary of exoplanet science (detection and characterization) and recent results from JWST for incoming OSU freshmen in physics and astronomy.

**OSU Undergraduate Residential Summer Access (URSA) Program** **2021 & 2022**
Co-organizer and co-instructor for a 2-week long summer early arrival program aimed at incoming OSU freshmen in physics and astronomy.

**Guest presenter for OSU's Astronomical Society** **11/20**
Presented on the atmospheric dynamics of ultra-hot Jupiters KELT-9 b and KELT-20 b.

## Outreach Presentations

**Westerville Library** **6/23**
Developed a presentation for children introducing how to find exoplanets with live demos illustrating the transit and radial velocity detection methods. Presented by Liam Dubay due to illness on the day of the presentation.

**Friends of Ohio State Astronomy and Astrophysics** **10/22**
Co-presented (with Kiersten Boley) "Exoplanets and the Search for Life with JWST" to a public audience at The Ohio State University.

**Columbus Astronomical Society** **04/20**
Co-presented a historical overview of women in astronomy with cohort (Kiersten Boley, Alison Duck, Ness Mayker, and Caprice Phillips).

## Technical Strengths

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|---|---|
| **Operating systems** | Linux/Unix, Windows |
| **Languages** | Python, MATLAB, Mathematica, R, HTML, CSS |
| **Scientific Software** | `numpy/scipy/astropy, emcee, dynesty, george, Spectroscopy Made Easy (SME), petitRADTRANS, p-winds` |
| **Miscellaneous** | Optics, LaTeX, GitHub |